Trend Study 3-9-01

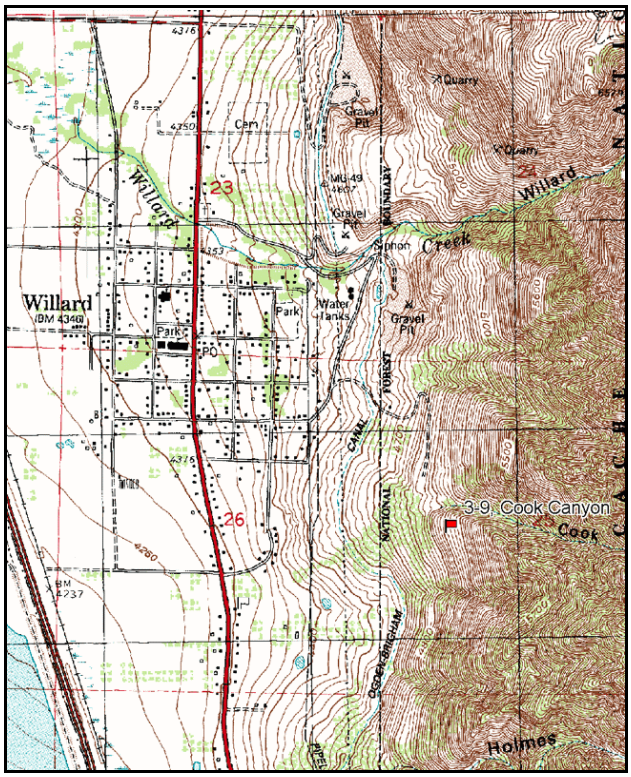
Study site name: Cook Canyon . Vegetation type: Big Sagebrush-Grass .

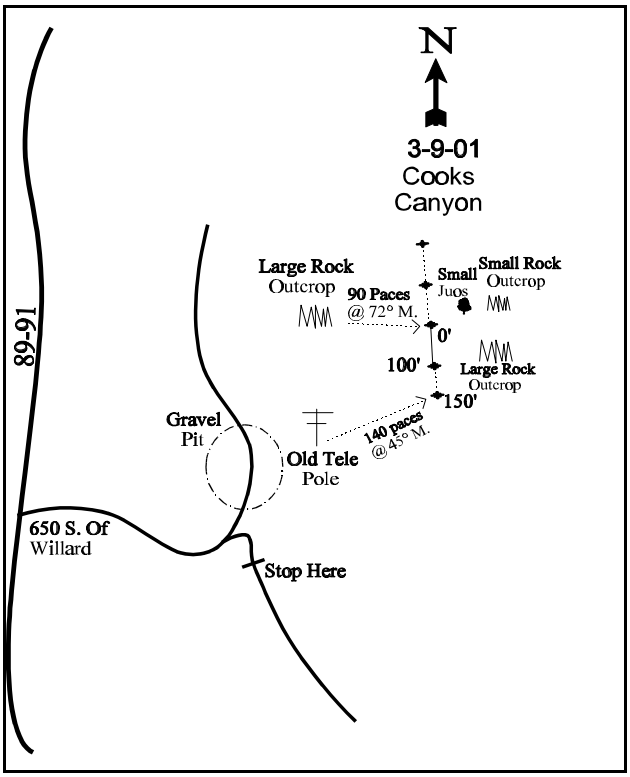
Compass bearing: frequency baseline 162 degrees magnetic.

Frequency belt placement: Line 1 (11 & 95ft), line 2 (34ft & 71 ft.), line 3 (59ft).

LOCATION DESCRIPTION

From the intersection of US-89/91 in Brigham City, proceed south 6.6 miles on US 89. Turn left (east) on 700 South (south of Willard) and go 0.6 miles to a gravel pit and the Ogden/Brigham Canal. From the point where the canal goes underground, take an azimuth of 30 degrees magnetic and walk approximately ¼ mile up the steep slope to a large rock outcrop. From the rock outcrop, take an azimuth of 87 degrees magnetic and walk 91 paces to the 0-foot stake of the frequency baseline, marked with a browse tag #7924.
Alternate route: Drive along canal road from White's Orchard to a gravel pit. Park here and walk up the slope at a bearing of 65 degrees magnetic for 1/4 mile. The 0-ft post is between two large rock outcrops.





Map Name: Willard

Diagrammatic Sketch

Township 8N , Range 2W , Section 25

UTM 4583504 N 414655 E

DISCUSSION

Trend Study No. 3-9

The Cook Canyon study is situated on a west-facing slope at 4,760 feet elevation, just south of Cook Canyon. The plant community is a mountain big sagebrush type with scattered white rubber rabbitbrush. It also contains widely scattered Utah juniper and Gambel oak clones. A sparse understory consists of warm season perennial grasses, annual grasses, and a few broadleaf weeds. The 35% to 45% slope is steep enough to contribute to some soil instability and erosion. Deer pellet groups occurred frequently in 1984, overall browse utilization was relatively heavy, suggesting that the area was an important wintering site through the critical winters of 1983-84. Two winter killed carcasses from those winters were found nearby. Deer use on available browse has been light from 1990-2001. Deer pellet groups had a quadrat frequency of only 8% in 1996 and 4% in 2001. Pellet group transect data taken in 2001 estimated 2 deer days use/acre (5 ddu/ha). No elk pellets have been sampled in any year.

The soil is "Wasatch Cobbly Sandy Loam" with a gravelly subsoil. The surface layer averages 17 inches in thickness, but is underlain by a highly permeable subsoil extending to below five feet in depth. Drainage is excessive and water holding capacity is poor. During the mid-summer period, the top 35 to 40 inches are often completely dry. The erosion hazard for this soil is moderate (Chadwick et al. 1975). The study site is very rocky and has incomplete plant cover. Soil at the site has a sandy loam texture with a soil reaction that is moderately acidic (6.0 pH). The soil is rocky with abundant gravel throughout the profile. Effective rooting depth was estimated at under 9 inches in 1996. Soil temperature is high, averaging 75.6° F at a depth of 10 inches. In 1996, erosion was moderate as evidenced by the prevalence of erosion pavement, gullies, rills and plant pedestaling. In 2001, erosion seemed to be more stabilized.

The key browse species is mountain big sagebrush. Other shrubs include a small population of broom snakeweed, an occasional mature white rubber rabbitbrush, a few junipers, and isolated patches of Gambel oak and bigtooth maple. During the initial reading in 1984, the mountain big sagebrush stand seemed rather sparse and slightly decadent. However, closer examination revealed the presence of abundant seedlings (5,800 per acre). The previous two or three years (1981-82) must have been highly favorable for seedling establishment. This same trend was apparent at several other locations along the front. Although, apparently few of the seedlings encountered in 1984 survived. During the 1990 reading, population density remained similar to 1984 estimates (2,399 and 2,599 plants/acre) with only a slight increase in young plants. Utilization was light and decadence relatively low at 21%. By 1996, population density declined slightly yet the number of mature plants was similar at 1,460 plants/acre. The largest decline came from the decadent age class which fell from 533 plants/acre to only 180 plants/acre. As a result, percent decadency declined to only 9%. Utilization was light and vigor normal. Seed production was extremely good in 1996. Percent decadency increased in 2001 to 29%, with 50% of this age class classified as dying. This points to a possible die-off in the future. Recruitment was low in 2001, and the average number of young plants since site establishment is not adequate to replace the number of dead, decadent and dying plants within the population. Plants displaying poor vigor also increased in 2001 to 21%. The extended drought, coupled with high competition from annual species in the understory, is most likely the cause of the negative parameters for sagebrush. Annual growth on sagebrush was relatively low in 2001 at less than 2 inches.

Like many sites along the front, the herbaceous understory on this site is dominated by annuals and weedy perennial forbs. Annual brome species and rattail fescue combine to produce 87% of the grass cover in 1996, declining to 56% in 2001. Cheatgrass and rattail fescue both decreased significantly in nested frequency in 2001, most likely due to drought. However, they are still abundant enough to pose a fire hazard, especially in years with normal or above-normal precipitation. Moderately abundant perennial species include Sandberg bluegrass, bluebunch wheatgrass, bulbous bluegrass and purple three-awn (a warm season increaser). As a

group, perennial grasses more than doubled in sum of nested frequency in 2001. Forbs are fairly diverse yet produce less than 10% of the total vegetative cover on the site. Annual forbs increased dramatically in both frequency and cover in 2001. The most common perennial species are dyers woad, Louisiana sagebrush, wild onion and fleabane.

1984 APPARENT TREND ASSESSMENT

This site appears to have an unacceptable rate of soil erosion and for this reason, soil trend appears to be declining. Plant composition may be at a turning point. The established mountain big sagebrush community appears decadent but could be rejuvenated by a large population of seedlings. If these succeed, they will ensure the continued dominance of big sagebrush. Herbaceous composition is somewhat depleted but seems relatively stable.

1990 TREND ASSESSMENT

Trend for big sagebrush is stable. Seedlings made up 71% of the population in 1984. In 1990, the stand is dominated by a slightly increased density of mature shrubs. The number of decadent plants declined while the number of young increased. Sagebrush canopy cover was estimated at 14%. The understory is largely cheatgrass, but there is a significant amount of Sandberg bluegrass, three-awn and bluebunch wheatgrass. Sum of nested frequency for perennial grasses and forbs increased since 1984, yet composition is still poor.

TREND ASSESSMENT
soil - stable (3)
browse - stable (3)
herbaceous understory - up slightly but poor composition (4)

1996 TREND ASSESSMENT

The soil trend is up due to a decline in percent bare ground from 7% to 1%. However, some erosion is still occurring even though herbaceous vegetation and litter cover is abundant and well dispersed. Trend for sagebrush is stable. Total density has declined slightly but the decrease comes primarily from the decadent age class. Utilization is light, vigor normal and percent decadence low at 9%. Trend for the herbaceous understory is down. Composition is poor and sum of nested frequency for perennial grasses has declined by 58%. Currently, annual grasses account for 87% of the grass cover. Forbs are limited and dominated by annuals and weedy species.

TREND ASSESSMENT
soil - up (5)
browse - stable (3)
herbaceous understory - down (1)

2001 TREND ASSESSMENT

Trend for soil is stable. Ground cover characteristics remain similar to 1996 levels. Bare ground is almost non-existent and protective cover from vegetation and litter are well dispersed. Trend for browse is slightly down. Mountain big sagebrush remains at a stable density, but percent decadency and poor vigor both increased. The number of decadent plants classified as dying also increased to 50%. These negative parameters are likely drought related and could improve with better precipitation in the future. The proportion of young plants is not adequate to replace the dead and decadent, dying individuals in the population. Trend for the herbaceous understory is slightly up. Sum of nested frequency for perennial grasses

doubled, while that of annual grasses decreased by 24%. Annual forbs did increase in frequency and cover, but forbs only provide 14% of the total herbaceous cover. The increase in perennial grass frequency outweighs the increase in annual forbs.

TREND ASSESSMENT
soil - stable (3)
browse - slightly down (2)
herbaceous understory - slightly up (4)

HERBACEOUS TRENDS --
Herd unit 03 , Study no: 9

Type	Species	Nested Frequency				Quadrat Frequency				Average Cover %	
		'84	'90	'96	'01	'84	'90	'96	'01	'96	'01
G	Agropyron spicatum	ab18	b37	a15	b42	11	14	6	18	.81	1.88
G	Aristida purpurea	c208	c184	b76	a39	76	70	31	14	2.40	1.23
G	Bromus japonicus (a)	-	-	8	-	-	-	2	-	.18	-
G	Bromus tectorum (a)	-	-	b350	a286	-	-	97	89	23.83	15.73
G	Festuca myuros (a)	-	-	b145	a95	-	-	52	36	2.98	1.96
G	Poa bulbosa	ab2	a-	b9	c72	1	-	6	26	.13	3.63
G	Poa secunda	a27	b130	a37	b151	13	61	20	54	.53	6.96
G	Sporobolus cryptandrus	7	5	13	3	4	3	6	2	.18	.21
Total for Annual Grasses		0	0	503	381	0	0	151	125	27.00	17.70
Total for Perennial Grasses		262	356	150	307	105	148	69	114	4.06	13.93
Total for Grasses		262	356	653	688	105	148	220	239	31.06	31.63
F	Achillea millefolium	-	-	3	3	-	-	1	1	.00	.18
F	Alyssum alyssoides (a)	-	-	-	5	-	-	-	2	-	.03
F	Allium spp.	a-	a-	a-	b35	-	-	-	21	-	.23
F	Arabis spp.	-	-	-	8	-	-	-	3	-	.01
F	Artemisia ludoviciana	a6	ab15	b25	ab9	3	6	12	4	.73	.21
F	Collomia linearis (a)	-	-	-	2	-	-	-	2	-	.01
F	Collinsia parviflora (a)	-	-	a2	b31	-	-	1	12	.00	.23
F	Descurainia pinnata (a)	-	-	-	7	-	-	-	3	-	.09
F	Draba spp. (a)	-	-	a-	b141	-	-	-	49	-	.66
F	Epilobium brachycarpum (a)	-	-	22	10	-	-	10	4	.10	.04
F	Erodium cicutarium (a)	-	-	a7	b57	-	-	3	26	.01	1.20
F	Erigeron spp.	-	-	b16	a2	-	-	7	2	.66	.04
F	Eriogonum spp.	-	-	-	1	-	-	-	1	-	.00
F	Euphorbia spp.	a-	a-	b14	a-	-	-	6	-	.22	-
F	Galium aparine (a)	-	-	a-	b7	-	-	-	5	-	.05
F	Helianthus annuus (a)	-	b5	a-	a-	-	5	-	-	.00	-

Type	Species	Nested Frequency				Quadrat Frequency				Average Cover %	
		'84	'90	'96	'01	'84	'90	'96	'01	'96	'01
F	Holosteum umbellatum (a)	-	-	$_{a}$5	$_{b}$137	-	-	2	48	.01	1.02
F	Isatis tinctoria	$_{a}$-	$_{b}$13	$_{c}$33	$_{bc}$21	-	7	16	11	.37	.11
F	Lactuca serriola	-	-	-	1	-	-	-	1	.00	.00
F	Machaeranthera canescens	-	-	-	5	-	-	-	3	-	.18
F	Microsteris gracilis (a)	-	-	4	6	-	-	2	2	.01	.03
F	Phlox longifolia	$_{a}$-	$_{ab}$11	$_{a}$7	$_{b}$15	-	5	2	9	.01	.46
F	Polygonum douglasii (a)	-	-	-	1	-	-	-	1	-	.00
F	Senecio multilobatus	-	-	4	-	-	-	2	-	.06	-
F	Sisymbrium altissimum (a)	-	-	1	-	-	-	1	-	.00	-
F	Tragopogon dubius	7	-	2	9	4	-	1	3	.00	.06
F	Unknown forb-perennial	-	-	-	4	-	-	-	2	-	.30
Total for Annual Forbs		0	5	41	404	0	5	19	154	0.15	3.40
Total for Perennial Forbs		13	39	104	113	7	18	47	61	2.09	1.81
Total for Forbs		13	44	145	517	7	23	66	215	2.24	5.22

Values with different subscript letters are significantly different at alpha = 0.10 (annuals excluded)

BROWSE TRENDS --
Herd unit 03 , Study no: 9

Type	Species	Strip Frequency		Average Cover %	
		'96	'01	'96	'01
B	Artemisia tridentata vaseyana	64	69	19.13	18.40
B	Chrysothamnus nauseosus albicaulis	3	0	.15	-
B	Chrysothamnus viscidiflorus viscidiflorus			.00	.03
B	Gutierrezia sarothrae	7	9	.96	.53
B	Juniperus osteosperma	0	4	-	2.14
B	Opuntia spp.	0	1	-	-
B	Quercus gambelii	1	2	.63	-
B	Unknown browse	0	2	-	-
Total for Browse		75	87	20.88	21.11

CANOPY COVER --
Herd unit 03 , Study no: 9

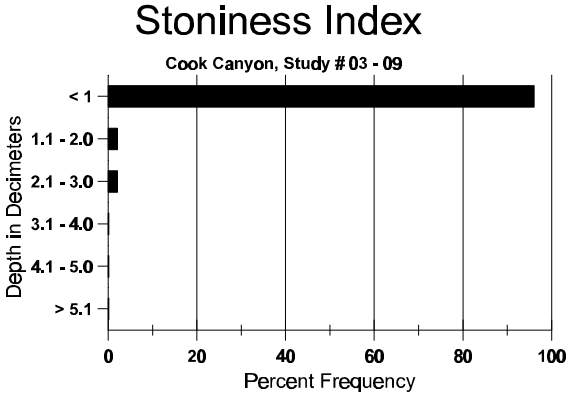
Species	Percent Cover '01
Juniperus osteosperma	2
Quercus gambelii	2

BASIC COVER --
Herd unit 03 , Study no: 9

Cover Type	Nested Frequency		Average Cover %			
	'96	'01	'84	'90	'96	'01
Vegetation	364	366	2.25	17.00	53.98	59.46
Rock	230	235	20.50	14.25	21.08	23.55
Pavement	77	75	8.50	5.50	.55	1.67
Litter	375	352	66.50	56.25	47.18	37.92
Cryptogams	35	54	.25	.50	.50	1.11
Bare Ground	88	77	2.00	6.50	.85	.91

SOIL ANALYSIS DATA --
Herd Unit 03, Study no: 09, Cook Canyon

Effective rooting depth (in)	Temp °F (depth)	PH	%sand	%silt	%clay	%0M	PPM P	PPM K	dS/m
8.9	75.6 (10.1)	6.0	54.7	26.0	19.3	1.8	13.5	131.2	.4



PELLET GROUP FREQUENCY --
Herd unit 03 , Study no: 9

Type	Quadrat Frequency		Pellet Transect	
			Pellet Groups per Acre	Days Use per Acre (ha)
	'96	'01	⍰01	⍰01
Rabbit	4	1	-	-
Deer	8	4	26	2 (5)

BROWSE CHARACTERISTICS --
Herd unit 03 , Study no: 9

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia tridentata vaseyana																		
S	84	87	-	-	-	-	-	-	-	-	87	-	-	-	5800			87
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	3	-	-	-	-	-	-	-	-	3	-	-	-	60			3
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
Y	84	1	-	1	-	-	-	-	-	-	2	-	-	-	133			2
	90	6	-	-	-	-	-	-	-	-	6	-	-	-	400			6
	96	13	-	-	-	-	-	-	-	-	13	-	-	-	260			13
	01	4	-	-	-	-	-	-	-	-	4	-	-	-	80			4
M	84	-	1	21	-	-	-	-	-	-	22	-	-	-	1466	23	39	22
	90	25	-	-	-	-	-	-	-	-	25	-	-	-	1666	24	32	25
	96	71	2	-	-	-	-	-	-	-	73	-	-	-	1460	27	47	73
	01	65	6	-	-	-	-	-	-	-	68	-	3	-	1420	29	42	71
D	84	-	1	11	-	-	-	-	-	-	9	1	2	-	800			12
	90	8	-	-	-	-	-	-	-	-	-	3	3	2	533			8
	96	7	2	-	-	-	-	-	-	-	8	-	-	1	180			9
	01	26	4	-	-	-	-	-	-	-	11	-	4	15	600			30
X	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	520			26
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	440			22

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	06%	92%	06%	+ 8%
'90	00%	00%	13%	-27%
'96	04%	00%	01%	+10%
'01	10%	00%	21%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'84	2399	Dec:	33%
	'90	2599		21%
	'96	1900		9%
	'01	2100		29%

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Chrysothamnus nauseosus albicaulis																		
Y	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
M	84	1	-	-	-	-	-	-	-	-	1	-	-	-	66	21	22	1
	90	1	-	-	-	-	-	-	-	-	1	-	-	-	66	25	31	1
	96	2	-	-	-	-	-	-	-	-	2	-	-	-	40	38	63	2
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0	37	43	0

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	00%	00%	00%	+ 0%
'90	00%	00%	00%	- 9%
'96	00%	00%	00%	
'01	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
'84	66	Dec:		-
'90	66			-
'96	60			-
'01	0			-

Gutierrezia sarothrae																		
S	84	5	-	-	-	-	-	-	-	-	5	-	-	-	333			5
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
Y	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	01	2	-	-	-	-	-	-	-	-	2	-	-	-	40			2
M	84	32	-	-	-	-	-	-	-	-	32	-	-	-	2133	15	14	32
	90	12	-	-	-	-	-	-	-	-	12	-	-	-	800	10	11	12
	96	11	-	-	-	-	-	-	-	-	11	-	-	-	220	14	20	11
	01	13	-	-	1	-	-	-	-	-	14	-	-	-	280	12	18	14
X	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	20			1

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	00%	00%	00%	-62%
'90	00%	00%	00%	-73%
'96	00%	00%	00%	+31%
'01	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)			
'84	2133	Dec:	-
'90	800		-
'96	220		-
'01	320		-

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Juniperus osteosperma																		
M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	01	3	-	-	-	-	-	-	-	-	3	-	-	-	2280	-	-	114

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor
'84	00%	00%	00%
'90	00%	00%	00%
'96	00%	00%	00%
'01	00%	00%	00%

%Change

Total Plants/Acre (excluding Dead & Seedlings)				
	'84	0	Dec:	-
	'90	0		-
	'96	0		-
	'01	2280		-

Opuntia spp.																		
M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0	7	19	0
	01	1	-	-	-	-	-	-	-	-	1	-	-	-	20	5	12	1

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor
'84	00%	00%	00%
'90	00%	00%	00%
'96	00%	00%	00%
'01	00%	00%	00%

%Change

Total Plants/Acre (excluding Dead & Seedlings)				
	'84	0	Dec:	-
	'90	0		-
	'96	0		-
	'01	20		-

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Quercus gambelii																		
M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	3	-	-	-	-	-	-	-	-	3	-	-	-	60	-	-	3
	01	5	-	-	-	-	-	-	-	-	5	-	-	-	100	-	-	5
X	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	20			1

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	00%	00%	00%	
'90	00%	00%	00%	
'96	00%	00%	00%	+40%
'01	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
'84	0	Dec:		-
'90	0			-
'96	60			-
'01	100			-

Unknown browse																		
M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0	48	75	0
	01	-	-	-	2	-	-	-	-	-	2	-	-	-	40	21	68	2

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	00%	00%	00%	
'90	00%	00%	00%	
'96	00%	00%	00%	
'01	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)			
'84	0	Dec:	-
'90	0		-
'96	0		-
'01	40		-